

2002

Distributions and Geographical Relationships of the Polygyrid Land Snails (Mollusca, Gastropoda, Polygyridae) of Arkansas

Gerald E. Walsh

Brian F. Coles

Follow this and additional works at: <https://scholarworks.uark.edu/jaas>



Part of the [Zoology Commons](#)

Recommended Citation

Walsh, Gerald E. and Coles, Brian F. (2002) "Distributions and Geographical Relationships of the Polygyrid Land Snails (Mollusca, Gastropoda, Polygyridae) of Arkansas," *Journal of the Arkansas Academy of Science*: Vol. 56, Article 31.

Available at: <https://scholarworks.uark.edu/jaas/vol56/iss1/31>

This article is available for use under the Creative Commons license: Attribution-NoDerivatives 4.0 International (CC BY-ND 4.0). Users are able to read, download, copy, print, distribute, search, link to the full texts of these articles, or use them for any other lawful purpose, without asking prior permission from the publisher or the author.

This Article is brought to you for free and open access by ScholarWorks@UARK. It has been accepted for inclusion in *Journal of the Arkansas Academy of Science* by an authorized editor of ScholarWorks@UARK. For more information, please contact scholar@uark.edu, uarepos@uark.edu.

Distributions and Geographical Relationships of the Polygyrid Land Snails (Mollusca, Gastropoda, Polygyridae) of Arkansas

Gerald E. Walsh*
9 Yocum Road
Rogers, AR 72756

Brian F. Coles
4202 Scottie Smith Drive
Jefferson, AR 72079

*Corresponding Author

Abstract

The Arkansas distributions of land mollusks of the family Polygyridae are presented based on the results of a state-wide survey and a critical review of published and unpublished locality records. Six of the 45 species previously recorded for Arkansas are excluded because they were misidentified, do not have established populations in the state, or are found only as fossils. Four others are not mapped because of a lack of recent distributional data or because the specific status of a form is unclear. There is a predominant pattern of occurrence limited to the northern, northwestern, or western parts of the state. The northwest has rock outcrops, including the limestone and dolomite outcrops of the Ozark Mountains, extensive broadleaf woodland cover, and has suffered less disturbance from agriculture than the southeast, which results in more suitable land mollusk habitats in the northwest. Secondary patterns are apparent for species that are of widespread or sporadic distribution throughout the state, or found only in the eastern part of the state. Compared to adjoining states, Arkansas has a high diversity of polygyrid snails, exceeded only by Tennessee (59 species) and Texas (40 species). The highest number of co-occurrences is between Arkansas and Missouri (94.1%) and Arkansas and Oklahoma (92.3%). Arkansas shares 36.9% of species with states that border the eastern side of the Mississippi River and 63.1% with states that border the western side of the river. These data illustrate the dominance of the Ozark/Boston Mountains fauna on Arkansas land snail distribution plus what could be regarded as a secondary mid-western element.

Introduction

Gastropod land mollusks of the family Polygyridae form a conspicuous, diverse, and in some cases abundant, component of woodland invertebrate land faunas, with many species of highly restricted distribution. There are approximately 160 species of polygyrids in the eastern United States (Hubricht, 1985); they are classified into two subfamilies and represent approximately 30% of the eastern United States land mollusks. The evolutionary significance, conservation priorities, and several aspects of polygyrid biology have been discussed by Emberton (1988, 1991, 1995).

Forty-five of the 144 terrestrial mollusks reported for Arkansas (Coles and Walsh, 1999) are in the family Polygyridae. An earlier report listed 35 polygyrid species of a total of 107 (Gordon, 1980). Both reports indicate that, as in the eastern United States as a whole, polygyrids represent approximately 30% of the Arkansas snail fauna, including species endemic to the state or of highly restricted distribution (Pilsbry, 1940; Hubricht, 1985; Robison and Smith, 1982; Coles and Walsh, 1999). We have further reviewed published distribution reports on the family Polygyridae and present new distribution records by county based on them, museum specimens, and our state-wide survey.

Materials and Methods

Species identifications were made from descriptions given by Baker (1939), Pilsbry (1940), Hubricht (1961), Cheatum and Fullington (1971), Leonard (1959), and Emberton (1988, 1991, 1995), and by reference to collections in the Field Museum of Natural History, Chicago, and the Academy of Natural Sciences of Philadelphia, Philadelphia. The taxonomic revisions of Emberton (1995) and revised names given by Turgeon et al. (1998) are incorporated in the list of Arkansas species.

Distributional maps of species in Arkansas were compiled at the county level. The following sources were used: collections made by the authors at over 400 sites, the unpublished collection of David Causey in the University Museum, University of Arkansas, Fayetteville; and distributions given by Pilsbry (1940), Hubricht (1985), and Emberton (1988, 1991). Thus, all counties of Arkansas have been included in map preparation, and all major habitat types (Coles and Walsh, 1999) have been sampled. Voucher material in the authors' collections will be deposited in the University Museum, University of Arkansas at Fayetteville, and the Field Museum of Natural History, Chicago.

The number of species in the Ozark Plateau (including the Boston Mountains, Ouachita Mountains, West Gulf Coastal Plain, and Mississippi River Alluvial Plain (including Crowley's Ridge and Grand Prairie) was determined in order

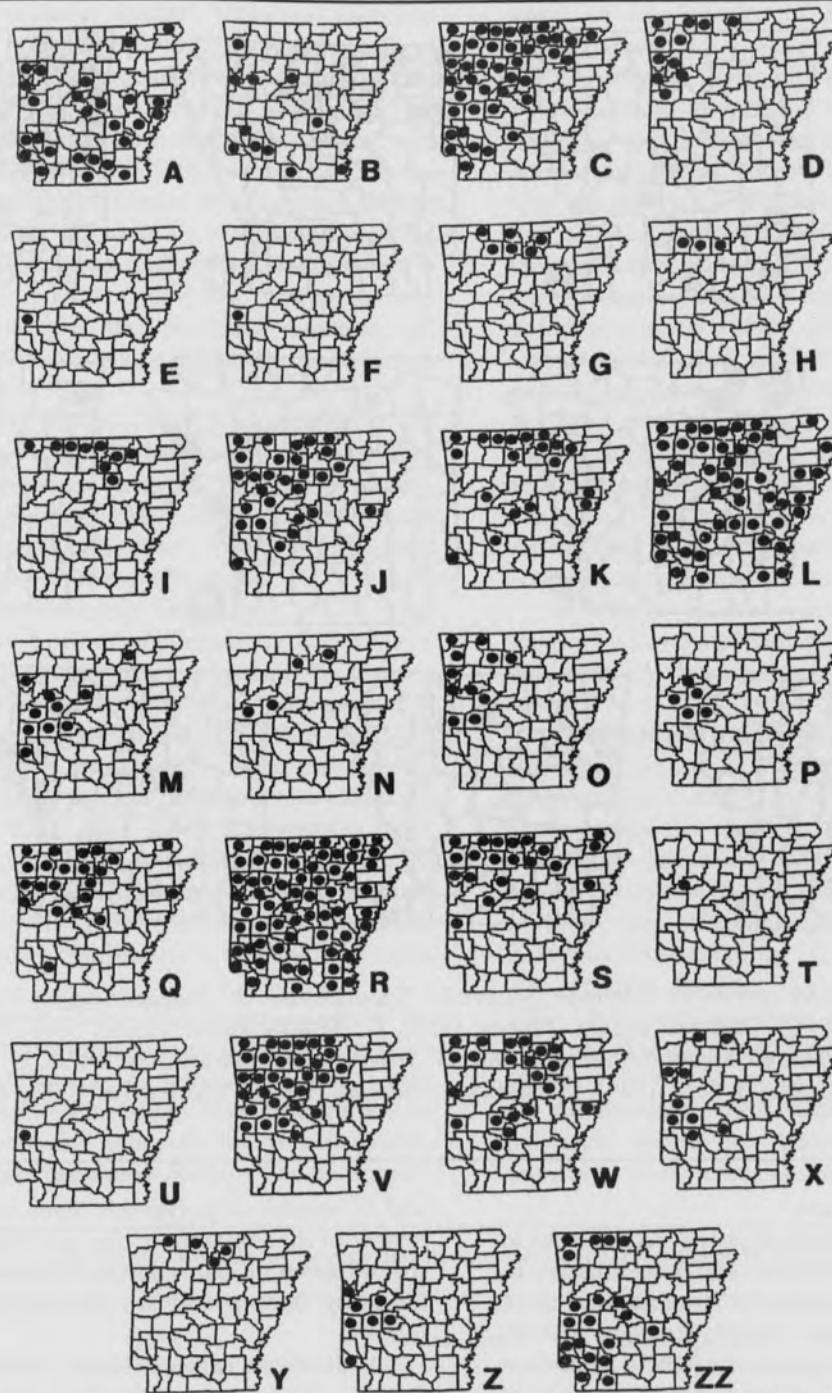


Fig. 1. Distributions of polygyrid species in Arkansas, Subfamily Polygyrinae. A. *Daedalochila leporina* (Gould, 1848), B. *Linisa texasiana* (Moricand, 1833), C. *Millerelix dorfeulliana* (I. Lea, 1838), D. *Millerelix jacksoni* (Bland, 1866), E. *Millerelix deltoidea* (Simpson, 1899), F. *Millerelix simpsoni* (Pilsbry and Ferriss, 1907), G. *Millerelix peregrina* (Rehder, 1932), H. *Millerelix* sp. nov., I. *Mesodon elevatus* (Say, 1821), J. *Mesodon zaletus* (A. Binney, 1837), K. *Mesodon clausus* (Say, 1821), L. *Mesodon thyroidus* (Say, 1816), M. *Patera binneyana* (Pilsbry, 1899), N. *Patera clenchi* (Rehder, 1932), O. *Patera indianorum* (Pilsbry, 1899), P. *Patera kiowaensis* (Simpson, 1888), Q. *Patera perigrapta* (Pilsbry, 1894), R. *Inflectarius inflectus* (Say, 1821), S. *Inflectarius edentatus* (Sampson, 1889), T. *Inflectarius magazinensis* (Pilsbry and Ferriss, 1907), U. *Stenotrema pilsbryi* (Ferriss, 1900), V. *Stenotrema labrosum* (Bland, 1862), W. *Stenotrema stenotrema* (Pfeiffer, 1842), X. *Stenotrema unciferum* (Pilsbry, 1900), Y. *Stenotrema blandianum* (Pilsbry, 1903), Z. *Euchemotrema fraternum imperforatum* (Pilsbry, 1900), ZZ. *Euchemotrema leai aliciae* (Pilsbry, 1893).

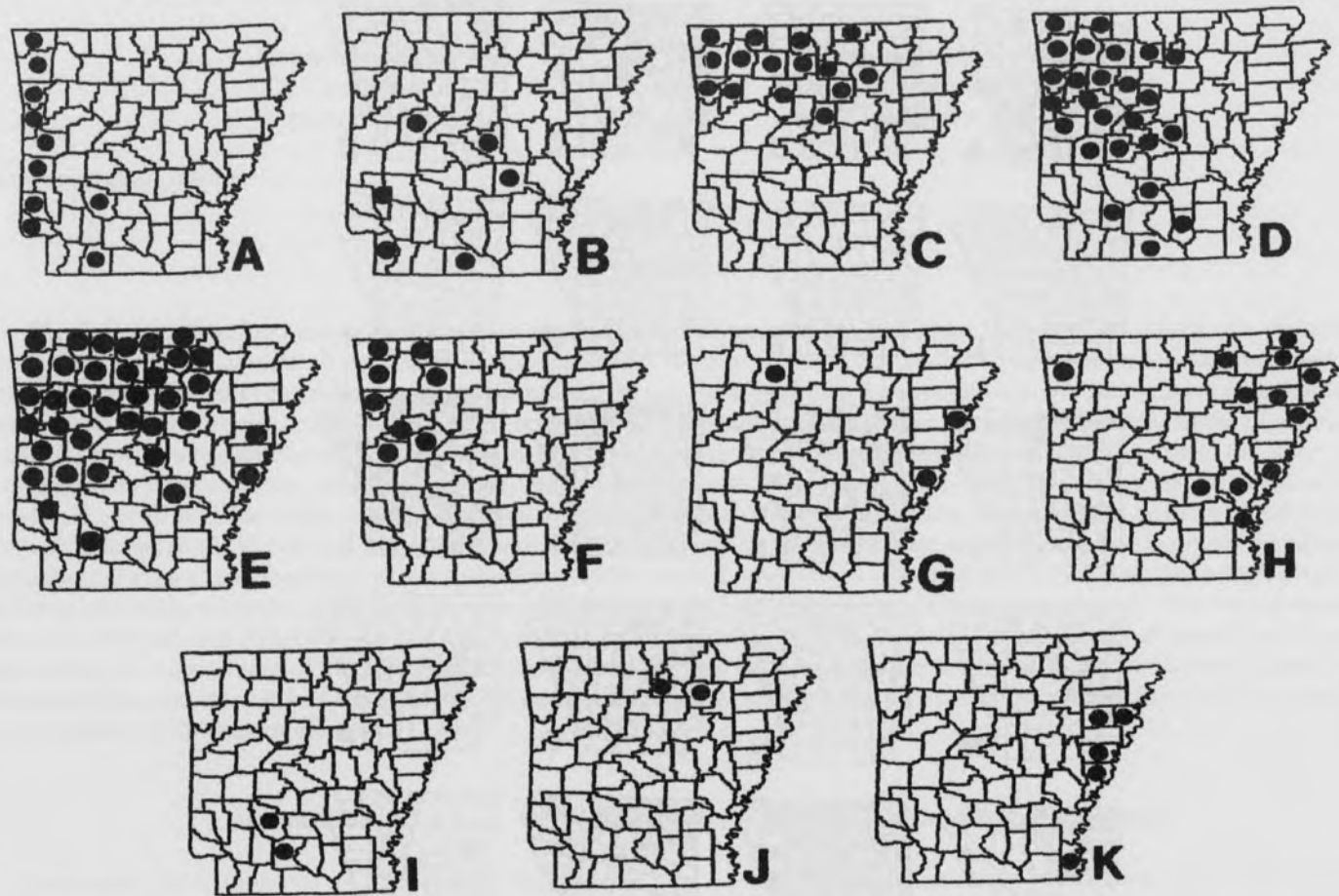


Fig. 2. Distributions of polygyrid species in Arkansas, Subfamily Triodopsinae. A. *Triodopsis cragini* Call, 1886, B. *Triodopsis hopetonensis* (Shuttleworth, 1852), C. *Triodopsis neglecta* (Pilsbry, 1899), D. *Neohelix divesta* (Gould, 1848), E. *Neohelix alleni alleni* (Sampson, 1883), F. *Neohelix albolabris bogani* Emberton, 1988, G. *Webbhelix multilineata* (Say, 1821), H. *Xolotrema fosteri* (F.C. Baker, 1932), I. *Xolotrema caroliniense* (I. Lea, 1834), J. *Xolotrema occidentale* (Pilsbry and Ferriss, 1907), K. *Xolotrema denotatum* (Férussac, 1821)

to evaluate patterns of distribution.

The numbers and distributions of polygyrid mollusks in states that border the Mississippi River and those adjacent to Arkansas, and the numbers common to Arkansas and these states were taken from Pilsbry (1940), Leonard (1959), Cheatum and Fullington (1971), Hubricht (1985), Emberton (1988, 1991), and the authors' collections. The number of species/km² was calculated for each state as an estimate of the area available for polygyrid habitat.

Results

Revised list of Arkansas Polygyridae.--The family Polygyridae is represented in Arkansas by two subfamilies, 13 genera, and 39 species (Figs. 1 and 2). We listed 15 genera

and 45 species of polygyrids from Arkansas in our earlier review of the literature (Coles and Walsh, 1999). Six of the species given in that report are deleted from the list for the following reasons and are omitted from the analysis that follows.

1. *Triodopsis vultuosa* (Gould, 1848) was reported from Benton, Washington, Crawford, Sebastian, and Nevada counties by Sampson (1894). At that time, *Triodopsis cragini* was treated as a form of *T. vultuosa* and it is possible that Sampson did not distinguish between the two species (Pilsbry, 1940).

2. *Stenotrema caddoense* (Archer, 1935) was first described as *Polygyra (Stenotrema) caddoense* by Archer (1935). Pilsbry (1940) reported it as *Stenotrema unciferum caddoense* from Caddo Gap, Montgomery County. Archer (1948) continued

to recognize it as a separate species. However, Hubricht (1972) found its shell morphology to be within the natural variation of *S. unciferum*, a fact mentioned by Pilsbry (1940), and placed it under *S. unciferum*. This view is supported by our examination of specimens from Arkansas.

3. *Linisa triodontoides* (Bland, 1861) was reported from Washington and Sebastian counties by Sampson (1893). Hubricht (1985) pointed out that *L. triodontoides* may be confused with *Linisa texasiana* and that *L. triodontoides* is found only south of Arkansas in Texas, Louisiana, and Mississippi. Based on size and apertural dentition, all populations of *Linisa* that we have examined from Arkansas are *L. texasiana*.

4. *Patera roemeri* (Pfeiffer, 1848) was reported from Arkansas by Gordon (1980). We have been unable to find other reports of this species in Arkansas and have not found it in our collections. Pilsbry (1940), Hubricht (1985), and Cheatum and Fullington (1971) listed it only from central Texas and one county in southern Oklahoma.

5. *Praticolella berlandierana* (Moricand, 1833) was reported from "Washita Springs", Arkansas, by A. Binney in 1851 (Pilsbry, 1940). A shell of this species is in the Causey collection at the University Museum, University of Arkansas, Fayetteville (Catalog Number 95-1-2000), but the collection site is not given in the notes of Dr. Causey. We have been unable to find "Washita Springs" in Arkansas on maps as early as 1840. The town of Washita is in Montgomery County near Lake Ouachita. An extensive search in the Washita/Lake Ouachita area failed to produce this species, which we believe to be adventive in Arkansas. The nearest documented distribution is in southern Texas (Hubricht, 1985).

6. *Allogona profunda* (Say, 1821) was reported by Hubricht (1985) as a fossil from Phillips County. This is an eastern and mid-western species (Hubricht, 1985), with fossils distributed along the Mississippi River from Illinois to Louisiana. We have not found living specimens in Arkansas.

Species of Uncertain Taxonomic Status.--The taxonomic

status of two species of *Millerelix* in Arkansas requires confirmation.

1. *Millerelix lithica* Hubricht, 1961 was described from Stone County by Hubricht (1961) as being similar to *Millerelix dorfeuilliana* but distinguishable on the basis of apertural dentition, notably the shape of the parietal lamella. Our searches in the region of the type locality have failed to find populations of *Millerelix* that consistently conform to Hubricht's description of *M. lithica*. Branson (1970) showed that *M. dorfeuilliana* is a highly variable species. We have stated previously (Coles and Walsh, 1999) that the shell characteristics of *M. lithica* fall within the variability of *M. dorfeuilliana*. However, Emberton (1995) retained *M. lithica* as a valid species without comment. We retain *M. lithica* as a valid species because we regard it as unwise to equate it with *M. dorfeuilliana* in the absence of critical morphological and anatomical data. Therefore, the distribution of *M. dorfeuilliana* (Fig. 1C) should be regarded as that of a potential aggregate of the two forms.

2. *Millerelix* sp. nov. was reported as an undescribed new species by Coles and Walsh (1999). A detailed description of this form has been prepared (Malacological Bull., *in review*).

Geographical Distribution of Polygyrids in Arkansas.--

The distributions of Arkansas polygyrids by county are given in Figs. 1 and 2. Inspection of the maps suggests that many species are restricted to the northwestern part of the state (e.g., *Stenotrema labrosum*, Fig. 1V). A few species exhibit restriction to western (e.g., *Triodopsis cragini*, Fig. 2A), northern (e.g., *Mesodon elevatus*, Fig. 1I), and eastern (e.g., *Xolotrema denotatum*, Fig. 2K) Arkansas or are cosmopolitan (e.g., *Mesodon thyroidus*, Fig. 1L and *Inflectarius inflectus*, Fig. 1R). On a sectional basis, the greatest number of species occurred in the north and west. Species diversity, as number of species/km², also followed this pattern (Table 1).

Comparison with Other States.--The number of polygyrid species in Arkansas is compared with those reported from surrounding states in Table 2. Only

Table 1. Species number and species density of polygyrids in four physiographic areas of Arkansas.

	Counties	Area, km ²	No. of Species	Species/km ²
Ozark Plateau	21	37,143	29	7.8 x 10 ⁻⁴
Ouachita Mts.	18	33,937	30	8.8 x 10 ⁻⁴
West Gulf Coastal Plain	16	28,620	16	5.6 x 10 ⁻⁴
Mississippi River Alluvial Plain	20	35,569	14	3.9 x 10 ⁻⁴

Table 2. Number of polygyrid species in Arkansas and surrounding states, with the percentage of polygyrid species they have in common with Arkansas.

State	Number of Polygyrid Species	% of Polygyrid Species in Common With Arkansas
Tennessee	59	20.3
Arkansas	39	-
Texas	40	17.5
Mississippi	27	48.1
Oklahoma	26	92.3
Missouri	17	94.1
Louisiana	16	75.0
Kansas	15	80.0

Table 3. Number of Polygyrid species, percentage in common with Arkansas, and species density in states north to south along the Mississippi River.

	No. of Polygyrid Species	% of Species in Common With Arkansas	No. of Species/ km ² x 10 ⁴
East of the Mississippi River			
Wisconsin	8	37.5	0.55
Illinois	11	47.6	1.43
Kentucky	39	30.8	3.73
Tennessee	59	20.3	5.40
Mississippi	27	48.1	2.19
	$\bar{x} = 28.8$	$\bar{x} = 36.9$	$\bar{x} = 2.66$
West of the Mississippi River			
Minnesota	7	28.6	0.32
Iowa	11	54.5	0.75
Missouri	17	94.1	0.66
Arkansas	39	-	2.83
Louisiana	16	75.0	1.27
	$\bar{x} = 18.0$	$\bar{x} = 63.1$	$\bar{x} = 1.17$

Tennessee, with 59 species, and Texas, with 40 species, have more polygyrid species than Arkansas. Tennessee and Mississippi have the fewest number of species in common with Arkansas. West of the Mississippi River, Texas shares only 17.5% of its species with Arkansas. Several aspects of these comparisons are misleading. Most of the 40 polygyrid species of Texas occur in the southern part of the state

(Cheatum and Fullington, 1971). The seven species that occur in the northern part of Texas, *Linisa texasiana*, *Daedalochila leporina*, *Millerelix dorfeuilliana*, *Mesodon thyroidus*, *Triodopsis cragini*, *Neohelix divesta*, and *Euchemotrema lei aliciae*, also occur in Arkansas. However, Cheatum and Fullington (1971) reported few species from western Texas and its panhandle, so these data will have to be re-evaluated

when further collections are made.

Similarly, the numbers for Tennessee and Kentucky include polygyrids that are present in the distinct molluscan faunas of the southern Appalachian and Cumberland Mountains. The western third of Tennessee has only 20 reported polygyrid species and shares 50% of them with Arkansas. The western third of Kentucky has 15 reported species and shares 66.7% of them with Arkansas. When so adjusted, Tennessee, Kentucky, Mississippi, and Louisiana share similar numbers with Arkansas.

Table 3 shows the numbers of polygyrid species, percentage of species held in common with Arkansas, and the number of species per state normalized for state area for states immediately to the west and east of the Mississippi River. This analysis shows that Arkansas has high diversity (third in abundance of species/km²) and highest diversity for states bordering the west side of the Mississippi River. There are also greater numbers of species and greater species density in states east of the Mississippi River, while those west of the river have a greater percentage of species in common with Arkansas.

Endemic species.—Several species appear to be endemic to Arkansas in the Ozark and Boston Mountains:

1. *Millerelix peregrina* (Rehder, 1932) was reported by Robison and Smith (1982) from IZard, Marion, Newton, Searcy and Stone counties. We found it in Carroll County.

2. *Millerelix* sp. nov. (Coles and Walsh, in review) has been found in Madison, Newton, and Searcy counties. This species has been identified as *Millerelix peregrina* by earlier workers. We found specimens in the Causey collection at the University of Arkansas Museum and the Hubricht collection at the Field Museum of Natural History.

3. *Patera clenchi* (Rehder, 1932) was reported by Robison and Smith (1982) from IZard and Yell Counties. We found it in Searcy and Scott counties.

4. *Xolotrema occidentale* (Pilsbry and Ferriss, 1907) was not listed by Robison and Smith (1982). We found it in Stone and Independence counties.

5. *Inflectarius magazinensis* (Pilsbry and Ferriss, 1907), listed by Robison and Smith (1982), continues to be found only on Mt. Magazine in Logan County. It was listed as a threatened species by the U.S. Fish and Wildlife Service (1989) with a recovery plan published in 1994.

Species of limited distribution.—The following species are of limited distribution in Arkansas:

1. *Millerelix deltoidea* was reported from Polk County and eastern Oklahoma by Hubricht (1985).

2. *Millerelix simpsoni* was reported from Polk County and eastern Oklahoma by Hubricht (1985).

3. *Stenotrema pilsbryi* (Ferriss, 1900) was reported from Polk County and eastern Oklahoma by Hubricht (1985).

4. *Webbhelix multilineata* (Say, 1821) was found in Newton and Phillips counties by the authors. It was reported

as a fossil from Crittendon County by Hubricht (1985). The species is common in the northern Midwest.

5. *Xolotrema carolinense* (I. Lea, 1834) is an eastern species reported by Hubricht (1985) for Clark and Ouachita counties. We have not found it in Arkansas.

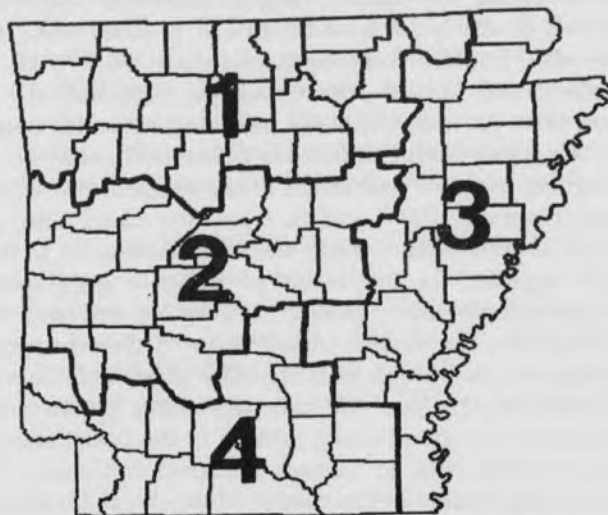


Fig. 3. Physiographic regions of Arkansas with number of polygyrid species in each: 1. Ozark Plateau (29 species); 2. Ouachita Mountains (30 species); 3. West Gulf Coastal Plain (16 species); 4. Mississippi River Alluvial Plain (14 species).

Discussion

The results detailed above indicate several facts concerning distribution of Arkansas polygyrid land mollusks: 1. Arkansas hosts a diverse polygyrid fauna; 2. the greatest number of species occurs in the Ozark and Boston Mountains. Fewest numbers occur in the West Gulf Coastal Plain and the Mississippi River Coastal Plain (Fig. 3); and 3. there is a tendency for Arkansas to show more similarity in polygyrid assemblage to states immediately west of the Mississippi River, than to those immediately east of the river. These observations support our assertion, made on the basis of the entire Arkansas land snail fauna (Coles and Walsh, 1999), that the diversity of Arkansas land snails is due to intrinsic diversity of species in the Ozark and Boston Mountains in the northwestern part of the state.

General aspects of this predominantly north-westerly distribution should be examined in more detail. The northwestern and southeastern halves of the state coincide with the boundary of the Mesozoic/Cenozoic rocks and the consequent differences in land use and natural vegetation communities. Thus, the north-west has rock outcrops,

including the limestone and dolomite outcrops of the Ozark Mountains, extensive broadleaf woodland cover, and has suffered less disturbance from agriculture than the south-east, resulting in more suitable land mollusk habitats occurring in the north-west of the state. For example, the distribution of *Stenotrema labrosum* (Fig. 1V) shows the most significant northwestern distribution of Arkansas polygyrids. Our collecting experience suggests that this species is restricted to the north-west because it requires woodland sites with boulder outcrops, including rock piles of woodland and upland stream valleys. Such habitats are absent from the east, south-east, and extreme south-west of the state. Conversely, *Inflectarius inflectus* (Fig. 1R) occurs throughout the state and much of the southeastern United States (Hubricht, 1985) and in many woodland sites. The pattern of predominant north-westerly distribution is, thus, better regarded as the result of intrinsic geographical localization enforced by geology, vegetation, and land use.

Similarly, the easterly distribution of *Xolotrema fosteri* also appears to be due to availability of suitable riparian woodland in the east of the state, although a population of this species was found under rubbish in the back yard of a home in West Fork in western Washington County. The national distribution of this species (Hubricht, 1985) shows a pattern consistent with riparian distribution in the south. Other factors that have to be considered when judging the validity of these analyses are that collecting efforts have varied from state to state and that published records are incomplete for Minnesota, Wisconsin, Iowa, and western Tennessee (Hubricht, 1985).

Distribution by humans can also confound biogeographical data. The distribution of *Triodopsis hopetonensis* (Fig. 2B) appears to be a case in point. This species of the southeastern United States was not recorded in Texas by Cheatum and Fullington (1971) or for Arkansas by Hubricht (1985). We have found it to be a common urban snail in eastern Texas and several localities in Arkansas, likely as a result of human transport.

The observation that Arkansas shares more species of polygyrid mollusks with states immediately to the west of the Mississippi River than with those immediately to the east of the river gives some support to the hypothesis that there is what should be regarded as a "mid-western" assemblage of land snails. This pattern of distribution has been identified for *Vertigo meramecensis* and *Gastrocopta rogersensis* (Gastrocopta, Pupillidae) that have disjunct distributions in northwestern Arkansas, Missouri, western Illinois, eastern Iowa, and southeastern Wisconsin (Nekola and Coles, 2001). The United States distributions of *Neohelix aleni* and *Millerelix dorfeuilliana* (Hubricht, 1985) suggest a similar pattern.

Whatever the causes of land snail distribution in Arkansas, sites in northwestern Arkansas that have high

land snail diversity should be regarded as being of high conservation priority.

ACKNOWLEDGMENTS.—We are grateful to the staff of the Arkansas Game and Fish Commission, the Ozark Saint Francis and Ouachita National Forests, the Nature Conservancy of Arkansas, and private land owners who have given permission to collect snails on their lands. In particular, we wish to acknowledge the assistance of G.O. Graening of the Nature Conservancy, Fayetteville, Gregg Butts of the Arkansas State Parks, Douglas Zollner of the Arkansas Field Office of the Nature Conservancy, Cindy Osborne of the Arkansas Natural Heritage Commission, George Oviatt of the Buffalo National River, and Nancy McCartney of the University Museum, University of Arkansas, Fayetteville.

Literature Cited

- Archer, A. F.** 1935. The ecology of the land Mollusca of Asheville, North Carolina. *Nautilus* 48:77-83.
- Archer, A. F.** 1948. Land snails of the genus *Stenotrema* in the Alabama region. *Pap. Alabama Mus. Nat. Hist.* 28:1-85.
- Baker, F. C.** 1939. *Fieldbook of Illinois Land Snails*. State of Illinois, Natural History Survey Division, Manual 2. Urbana. xi + 166 pp.
- Branson, B. A.** 1970. Shell variability in *Polygyra dorfeuilliana*. *Nautilus* 83:120-133.
- Cheatum, E. P. and R. W. Fullington.** 1971. The Aquatic and Land Mollusca of Texas, Part One: The Recent and Pleistocene Members of the Family Polygyridae in Texas. Dallas Museum of Natural History, Bull. 1, Dallas. vi + 74 pp.
- Coles, B. F. and G. E. Walsh.** 1999. Revised list of Arkansas terrestrial mollusks with notes on the geographic distribution of species. *J. Arkansas Acad. Sci.* 53:32-37.
- Coles, B. F. and G. E. Walsh.** *Millerelix (Prattelix) bisontes* (Gastropoda, Polygyridae), a new species from NW Arkansas, USA. *Malacol. Bull.*, *in review*.
- Emberton, K. C.** 1988. The genitalic, allozymic, and conchological evolution of the eastern North American Triodopsinae (Gastropoda: Pulmonata: Polygyridae). *Malacologia* 28:159-273.
- Emberton, K. C.** 1991. The genitalic, allozymic, and conchological evolution of the tribe Mesodontini (Pulmonata: Stylommatophora: Polygyridae). *Malacologia* 33:71-178.
- Emberton, K. C.** 1995. What shells do not tell: 145 million years of evolution in North America's polygyrid land snails, with a revision and conservation priorities. *Malacologia* 37:69-110.
- Gordon, M. E.** 1980. Recent mollusks of Arkansas with

- annotations to systematics and zoogeography. Proc. Arkansas Acad. Sci. 34:58-62.
- Hubricht, L.** 1961. Eight new species of land snails from the southern United States. Nautilus 75:26-33.
- Hubricht, L.** 1972. The land snails of Arkansas. Sterkiana 46:15-17.
- Hubricht, L.** 1985. The Distributions of the Native Land Mollusks of the Eastern United States. Fieldiana, NS (Zoology), No. 24. Field Museum of Natural History, Chicago. viii + 191 pp.
- Leonard, A. B.** 1959. Handbook of Gastropods in Kansas. The University of Kansas, Department of Biology and State Biological Survey. Misc. Pub. No. 20, Lawrence. 225 pp.
- Nekola, J. C. and B. F. Coles.** 2001. Systematics and ecology of *Gastrocopta (Gastrocopta) rogersensis* (Gastropoda, Pupillidae), a new species of land snail from the Midwest of the United States of America. Nautilus 115:105-114.
- Pilsbry, H. A.** 1940. Land Mollusca of North America (North of Mexico). Vol. 1, Part 2. The Academy of Natural Sciences of Philadelphia. pp. 575-994.
- Robison, H. W. and K. L. Smith.** 1982. The endemic flora and fauna of Arkansas. Proc. Arkansas Acad. Sci. 36: 52-57.
- Sampson, F. A.** 1893. Mollusca of Arkansas. Nautilus 7:33-35.
- Sampson, F. A.** 1894. Some Arkansas snails. Nautilus 8:36.
- Turgeon, D. D., J. F. Quinn, Jr., A. E. Bogan, E. V. Coan, F. G. Hochberg, W. G. Lyons, P. M. Mikkelsen, R. J. Neves, C. F. E. Roper, G. Rosenberg, B. Roth, A. Scheltema, F. G. Thompson, M. Vecchione, and J. D. Williams.** 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: Mollusks, 2nd Ed. American Fisheries Society, Special Publication 26, Bethesda, Maryland. viii + 526 pp.
- U. S. Fish and Wildlife Service.** 1989. Endangered and threatened wildlife and plants: Determination of *Mesodon magazinensis* (Magazine Mountain Shagreen) to be a threatened species. Fed. Reg. 54 (72):15206-15208.
- U. S. Fish and Wildlife Service.** 1994. Recovery plan for Magazine Mountain Shagreen. USFWS, Jackson, MS. 26 pp.